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# RESEARCH IN THE FIELD OF FAT AND PROTEINE SUPPLY IN GERMANY

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RESEARCH IN THE FIELD  
OF  
FAT AND PROTEINE SUPPLY IN GERMANY

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ALSOS Mission

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EUROPEAN THEATER OF OPERATIONS  
UNITED STATES ARMY  
ALSOS Mission

20 January 1945

SUBJECT: Research in the Field of Fat and Proteine Supply in Germany.  
(Status as of middle of 1944 to end of 1944)

The loss of large agricultural areas, such as the Ukraine has placed a heavy strain on Germany's food supplies. Whereas carbohydrates are still available in sufficient quantities, the already existing scarcity of fats increased markedly and the needs of proteine could not be answered by drawing on the usual sources (meats, fish, eggs, etc.). It was of vital importance, therefore to close or at least to reduce the existing "fat and protein hiatus" (Fett-und, Eiweisslücke). Research in this direction has been going on in Germany for many years and has, in many instances, produced remarkable results. The practical aspect of new foods (nutritional value, tolerability) was mostly studied in the "Kochwissenschaftliches Institut der Wehrmacht" in Frankfurt a.M. or in corresponding subsidiary laboratories. This institute is under the direction of an "Oberstapotheker" (Colonel pharmacist) and operates in close connection with the respective agency in the OKH under direction of W. Ziegelmayr in Berlin. (The latter is a well-known military nutrition expert and research man.) Also interested in the problem are all industries using fats as raw material and the Reichsnährstand. The main object of these researches consist in the search for new natural sources of fats and proteine and of the synthesis of fats and proteines. In addition, the problem of saving fat by promoting metabolic change of carbohydrate to fat within the human body is being studied.

1. Tapping of new fat and carbohydrate sources and synthesis.

a. Fats: Natural sources are now being sought more and more in the rape-seed, especially after the loss of the huge sunflower fields of the Ukraine. The oil recently extracted from rape-seed is considerably better than that of the War 1914-1918. By putting the seed through a press at moderate temperature and using new purification and filtering methods a satisfactory edible oil is obtained. This oil is as yet not equal to the usual edible oils (olive, sesame, peanut). Besides rape seed, tomato seed and grape seed is being used for the production of oil. Oil derived from the tomato seed is a food of

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highest quality and is comparable to the best edible oils. The two latter oils were first prepared in Italy. Nevertheless, the natural resources of fats and oils do not suffice by far to meet the demands. The rapidly developing synthesis of hydrocarbons and fatty acids in the last 10 years (directly from CO<sub>2</sub> and H<sub>2</sub> or by the way of hydrocarbons) suggested that the synthesis of fats (through esterifying fatty acids with glycerine) could soon be attempted on a large scale. In practice, however, it became apparent that the road from the fatty acid to an edible fat is extremely complicated and expensive. This is the main reason why direct synthesis has so far not been taken up on a large technical scale. Synthetic fat is however encountered in certain instances (in U-boats because it never gets rancid). Actually Imhausen fat synthesis furnished a high quality edible fat. Because of the above mentioned unsatisfactory aspects of a total fat synthesis from CO<sub>2</sub> + H<sub>2</sub> by ester formation, recourse was taken to biochemical methods. In this field fundamental progress was made. The Henkel A.-G., Damm, and other research workers succeeded in growing fat producing fungi (yeasts, fusaria) on entirely synthetic media. The source of carbon for this synthesis is sugar (also Pentose). With this method, it is easy to obtain fats from timber by way of sugar. After approximately 48 hours these fungi contain 15% of the original sugar supply in form of fat which is suitable for human consumption. In addition approximately 15% proteine is formed. The necessary nitrogen is derived from ammonium salts, nitrates, urea, amides, or easily synthesized amino acids (see paragraph b.)

b. Proteine: The meat resources of Germany were reduced markedly in 1942 and 1943. The sinking of the entire whaling fleet caused the disappearance of whale meat as a source of fats and proteine.

Proteine assumes a special place in human nutrition inasmuch as it can be only partly replaced by other substances (fats, carbohydrates). The human organism does not possess the capacity to form proteine. It has to be introduced from the outside (in form of animal or vegetable proteine). This "introduced proteine" is broken down in the intestine the components pass through the intestinal mucosa and are resynthesized to human proteine. It thus becomes apparent that not any available proteine is suitable for consumption.

Apart from animal muscle proteine, fish proteine is especially suitable as a source of all the required amino acids for human nutrition. Detrimental to the use of fish meal so far, was its bad taste and odor. In 1937 Metzner and Hiltner succeeded in preparing an entirely odorless and tasteless dried fish protein without altering its main constituents. It is known under the name of German-Fish-Proteine

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(Deutsches Fischeiweiss). Its chemical composition is similar to that of the egg-yolk. The proteine resources, however, were still highly insufficient. Recourse was therefore again taken to biochemical synthesis. Under paragraph "a" the possibilities of simultaneous fat and proteine synthesis by means of fungi was discussed. Proteine-rich yeasts were cultivated. Today, it is possible to grow yeasts (according to Damm) whose fat and proteine content corresponds to about 30% of the original raw material, which consists of sugar (wood sugar) and various anorganic nitrogen compounds (see above).

A "Fungusliverwurst" was prepared from this material, which in taste and odor, was not unlike that of real liverwurst. However, experimental investigation of this material in animals and humans over a period of several months showed that in the event of an exclusive nutrition with this "fungus-proteine" liver damage occurred. The reason was found in the absence of thioaminoacids (particularly cysteine and cystine). It has been shown experimentally that in the presence of these vital amino acids (pure or in form of animal or fish proteine) damage of the liver did not occur.

In the last two years great effort was also dedicated to the salvage and usage of proteine rich oil seed residues. (Sunflower and rape) for human nutrition. At present experimental work with rape seed residue is being carried out under the direction of Professor Morell of the Unilever-Sunlight Group. The main difficulty is encountered in the removal of the partly poisonous bitter and irritant components of the rape seed residue. A special method was developed by the informant. This method can also be utilized to render cottonseed residues suitable for human consumption (removal of the gossypol) and should be of interest to U.S. sources (detailed information available if desired).

## 2. Fat economy by promoting fat synthesis from carbohydrate within the body.

Recent research on vitamins, wheat and rye germination has shown that vitamin B1 plays an essential role in the formation of fat from carbohydrate in intermediate metabolism. It might be possible, therefore, to save fat by administration of vitamin B1 in the presence of a carbohydrate-rich diet. The fat would then be formed within the human or animal organism itself from carbohydrate.

### Summary:

A brief survey is given of the work done in Germany for the purpose of compensating the acute fat and proteine shortage. A description is given of the sources of raw material (tomato seed-oil, grape

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seed oil, fish proteins, oilseed proteins), and of a synthesis (total synthesis of fats and biochemical synthesis of fat and proteins by fungi from sugar and nitrogen compounds). Finally the possibilities of economizing on fat by taking advantage of the metabolic transformation of carbohydrate into fat within the human organism are considered.

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